LBNE Reconfiguration Update

NOνA Collaboration Meeting

Minneapolis

3 August 2012

Gary Feldman

History

- The LBNE collaboration proposed a 34 kt LA TPC detector at the Homestake mine in South Dakota.
  - The estimated cost, including a new beamline from Fermilab was about $1.8 B.
- On March 16, 2012, Bill Brinkman, Director of the DOE Office of Science to Pier Oddone:

Based on our considerations, we cannot support the LBNE project as it is currently configured. This decision is not a negative judgment about the importance of the science, but rather it is a recognition that the peak cost of the project cannot be accommodated in the current budget climate or that projected for the next decade.

In order to advance this activity on a sustainable path, I would like Fermilab to lead the development of an affordable and phased approach that will enable important science results at each phase. Alternative configurations to LBNE should also be considered.

Response

- Fermilab's response was to appoint 3 committees
  - Steering Committee
    - Physics Committee
    - Cost/Engineering Committee
  - The Steering Committee was to propose options, which would be evaluated for physics by the Physics Committee and costed by the Cost/Engineering Committee

Steering Committee

Steering Committee	
Young-Kee Kim, FNAL (Chair)	LBNE LOG (Lab Oversight Group) member
James Symons, LBNL	LBNE LOG (Lab Oversight Group) member
Steve Vigdor, BNL	LBNE LOG (Lab Oversight Group) member
Bob Svoboda, UC Davis	LBNE co-spokesperson
Kevin Lesko, LBNL	SURF (Sanford Underground Research Facility) head
Gary Feldman, Harvard	NOvA co-spokesperson
Mel Shochet, U.Chicago	Physics working group chair, Former HEPAP chair
Mark Reichanadter, SLAC	Engineering/Cost working group chair DOE DUSEL review committee co-chair
Charlie Baltay, Yale	P5 chair
Jon Bagger, JHU	Former HEPAP deputy chair
Ann Nelson, UW, Seattle	HEPAP member

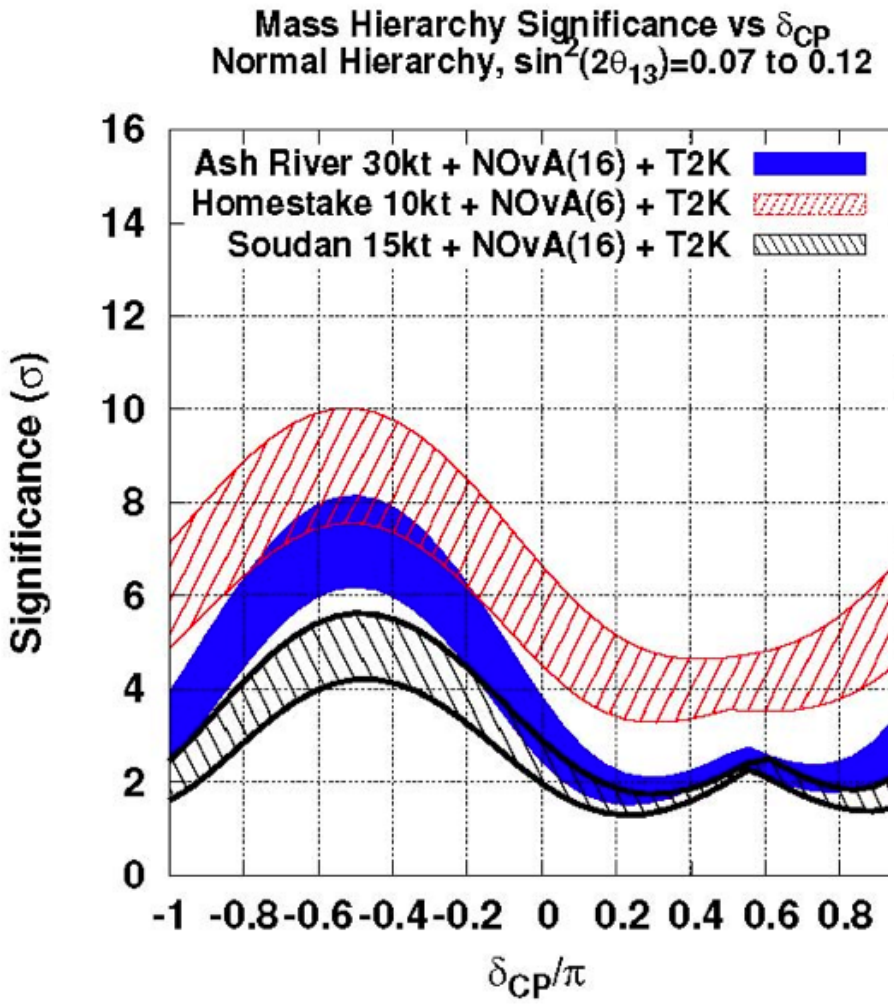
Steering Committee: Ex-officio members	
Andy Lankford, UC Irvine	HEPAP chair, DUSEL NRC study chair
Steve Ritz, UC Santa Cruz	PASAG (Particle Astrophysics Scientific Assessment Group) chair, Fermilab PAC member
Jay Marx, Caltech	DOE DUSEL review committee co-chair
Pierre Ramond, U. Florida	DPF chair
Harry Weerts, ANL	DOE Intensity Frontier Workshop co-chair
JoAnne Hewett, SLAC	DOE Intensity Frontier Workshop co-chair
Jim Strait, FNAL	LBNE Project Manager Engineering/Cost working group deputy chair
Pier Oddone, FNAL	Director, Fermilab
Susan Seestrom, LANL	LBNE LOG (Lab Oversight Group) member

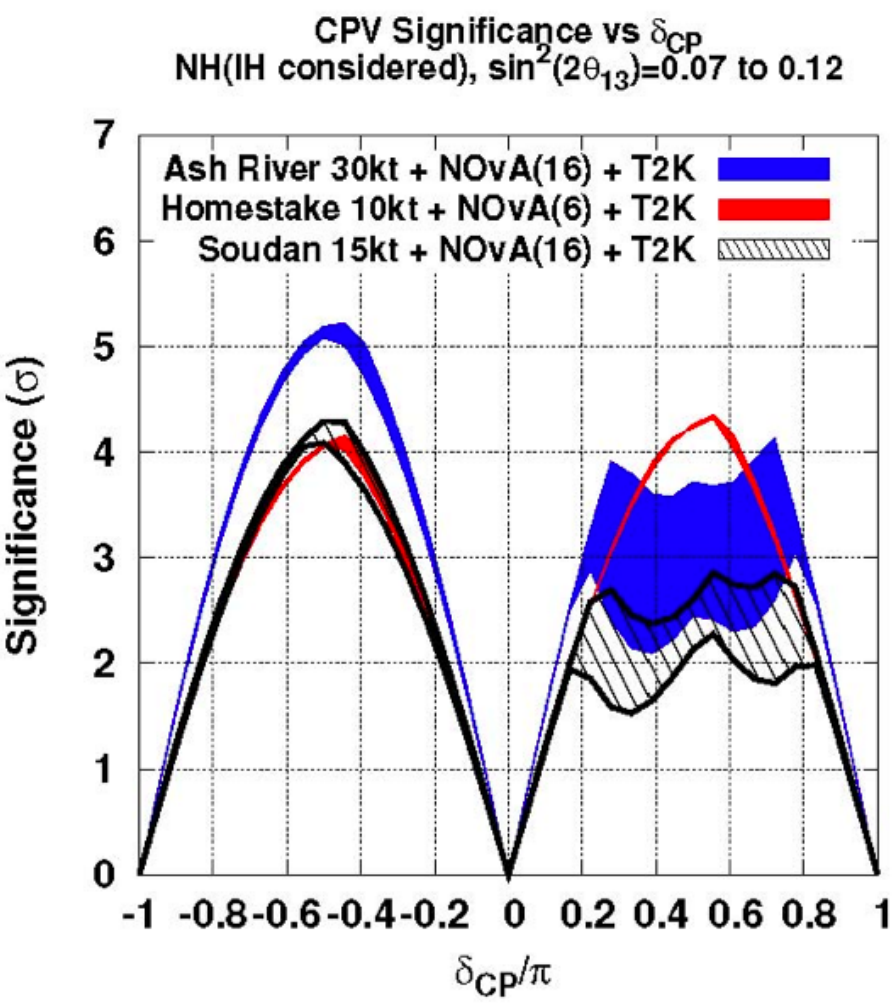
Options

- The ground rules were vague: cost $600 M to $700 M, but certainly < $750 M, which requires acquisition authority above the Office of Science.
- Options: All liquid argon TPCs

Location	Mass	Beam	Cost	Distinction
Ash River Surface	30 kt	NuMI	$700 M	Best for CP
Soudan Underground	15 kt	NuMI	$700 M	Only underground
Homestake Surface	10 kt	New	$800 M No ND	Best for mass ordering

Option Sensitivities





Interim Report

- On June 5, 2012, the Steering Committee issued its interim report, favoring the Homestake option. Reasons:
  - Better sensitivity to the mass ordering.
  - Clear Phase 2: The original 34 kt detector underground.
- This was presented to the DOE Office of Science, and the DOE accepted it and called for a CD-1 review by Halloween, with the Homestake option as the reference design.
- Given the DOE position, the Steering Committee delayed its final report for two additional reports from the Physics Committee, one on the absence of a near detector and the other on the ability of LA to work on the surface.

Discussion (My Views)

- No one really likes the Homestake option.
  - Most projects get descoped in the process of being baselined and meeting the realities of construction. There is no room for descoping here without making the project unviable.
  - A third-generation detector without a near detector is not an attractive approach.
    - The argument put forward by proponents is that due to its low mass, the proposed experiment is statistically limited.

Discussion (continued)

- A LA far detector on the surface is not optimum.
  - It does not allow for underground physics, such as proton decay and supernova detection.
  - It has not been shown to work, and at best makes getting good results much more difficult.
    - The 1.4 ms drift time in the LA makes the cosmic background between 140 and 14,000 times worse than it is in NOνA.
      - Proponents point to photon counters to do fast timing. This is very difficult because the system has to be able to discriminate between light from a candidate event and a nearby cosmic. I have not seen a design that would do this.
      - PAC report: The PAC also concurs with the Steering Committee's inclusion of the unresolved technical risk of operating on the surface, due to the large flux of particles from cosmic rays. Despite the optimistic initial estimates, this remains a key technical risk that must be managed and resolved. A large reduction in the fiducial volume would make the experiment unviable. Therefore, the PAC recommends that the underground options (Homestake, Soudan) be maintained, at least until this risk has been retired.

Discussion (continued)

- Pier is gambling on being able to find about $200 M from other sources (foreign, NSF, South Dakota, private) to fund the ND and put the FD underground.
  - Our Indian collaborators are willing to build a world-class near detector, but they still need a cavern to put it in.
  - Possible, but I think it is a long shot.